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Great To Have You Here! - Understanding And Designing Social Presence In Information Systems

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Abstract

Technologically created social presence (SP), i.e. the feeling of human contact, is gaining in importance in today's digital world where interaction becomes more and more impersonal. However, information systems (IS) research lacks a clear notion of both the concept itself and possible technological design decisions that could foster SP. Within this paper, we address this gap by providing an overview over the theory of SP for utilization in IS research. First, we develop a framework of SP dimensions and design dimensions of SP from related psychological literature. Then, we use this framework to analyze existing design choices in IS journal papers and point out shortcoming in the IS field. Our results suggest that IS needs to broaden its scope beyond iterating media richness to evoke social presence. Furthermore, current IS research mainly focuses on emotional aspects of social presence and neglects the evaluative dimension of the construct. Our paper concludes with a discussion of limitations and an outlook on potential future research in this context.

Keywords: Social Presence, Social Facilitation, Media Richness.

1 Introduction

Many of today's social interactions in both business and private environments are fully digitalized, thereby minimizing the personal contact between subjects. Media technologies enable us to interact with each other over distance and more and more of our daily interaction is mediated by technology. For example, this trend is evident when looking at the exploding number of available online services. While people had to interact personally with each other in the past for many services (e.g. government services, shopping), communication and interaction has become rather impersonal today. For instance, the case of E-Government shows that lack of personal contact is still among the most important factors for non-usage of the digital services (European Commission, 2008). Thus, people want to stay connected and feel close to each other even in fully digital environments. The importance of social media, i.e. technological implementations evoking this feeling, is continuously growing in both private and business environments (IJsselsteijn, Baren, & Lanen, 2003). For the business context, social presence (SP) is an important factor for technology-mediated interaction both internally and with external stakeholders. For instance, creating E-business websites that evoke the feeling of human warmth has been shown to positively influence internet shopping behavior (Pavlou, Liang, & Xue, 2007) and, thus, create higher revenue for companies. Furthermore, fostering SP in internal employee interaction may positively influence work performance. If people feel the presence of others, they perform significantly better on routine tasks, known as social facilitation (Aiello & Kolb, 1995; Davidson & Henderson, 2000; Kolb & Aiello, 1997). These examples show that SP needs to be considered in the design of both IS that are accessed by external stakeholders and company-internal IS infrastructure.

However, the concept of SP is not conceptualized clearly in IS literature. While the construct itself, as developed in psychological research, has many different dimensions, IS research often neither explicitly recognizes these dimensions nor implicitly differentiates between them when carrying out experiments. In this context, Schultze speaks of a multi-faceted nature of the phenomenon and states that "extant literature fails to align the different theories of presence with the various forms of presence" (Schultze, 2010) (p. 446). Due to this misalignment, it is still mostly unclear how specific technological design choices affect SP and, thus, how information systems need to be designed in order to foster it.

The objective of this paper is to target this research gap and provide an overview over the theory of SP for utilization in IS research. First, we explore the concept of SP itself. How is SP defined and what aspects does it entail? Are all of these aspects addressed in IS research? Second, our study seeks to reveal and structure the antecedents of SP in term of IS design choices. How can information systems design stimulate SP? In order to achieve our research objective and to address the research questions, the remainder of the paper is structured as follows. Section two outlines related work on SP and develops a framework containing different dimensions of the construct from literature. In section three, the methodology of our research is described. Section four then presents the results of our IS literature analysis using the previously developed framework as a structuring device. Section five concludes our paper with a discussion of implications for theory and practice as well as limitations of our study and potential future research opportunities.

2 Development of a Social Presence Framework

2.1 The Social Presence Construct

One of the first definitions of SP dates back to 1976 when Short, Williams and Christie referred to it as the degree to which a medium allows an individual to establish a personal connection with others that is close to face-to-face interaction. In their work they refer to classical communication media such as

telephone, fax and experimental phones with transmission of audio-visual signals. Historically, SP stems from the field of social psychology. That is also true for research on how SP affects cognition (social facilitation theory) which has a long history in this research area (Bond & Titus, 1983).

More recent definitions emphasize the psychological character of SP as an individual experience of closeness to and connectedness with others (Biocca, 1997). The difference between the definitions becomes salient when the related measurements are taken into account. While Short et al. refer to the subjectively perceived "warmth" of a communication medium, Biocca, Harms, & Gregg (2001) assess the degree of interactivity and mutual understanding of the communication partner. This latter cognitive approach of understanding SP can also be seen in the light of social facilitation. Knowing to be monitored by others (e.g. a supervisor) influences performance across different task scenarios (Zajonc, 1965). Another distinction refers to the question whether SP shall be conceptualized as a unidimensional (e.g. Short et al., 1976) or multidimensional variable (Biocca & Harms, 2002). In the latter case SP is conceptualized in a model containing three stages: 1) the perceptual level (co-presence of the embodied other), 2) the subjective level (psychobehavioral accessibility of the other) and 3) the intersubjective level (the interaction between the user and the other).

In the past, many different design choices of SP were studied. Before the year 2000, research of SP and social facilitation focused on the distinction between basic types of distant communication such as telephone, fax and email (also see media-richness theory (Daft & Lengel, 1986)) as well as the difference between face-to-face versus computer-mediated communication in general. Nowadays, the advance of the internet and computer technologies brought along various design choices for SP. For example, there are studies that show that socially rich visual elements such as the embedding of human pictures in e-commerce websites lead to higher SP (Cyr, Head, Larios, & Pan, 2009). Other studies show the influence of consumer recommendations in websites (Kumar & Benbasat, 2006). Moreover, virtual agents are able to foster social presence (Hess, Fuller, & Campbell, 2009) and are even tested in social facilitation settings (Zanbaka, Ulinski, Goolkasian, & Hodges, 2004). Latest trends are, for instance, collaborative online-shopping scenarios in which screen-sharing is used to reach improve performance (Zhu, Benbasat, & Jiang, 2010). Recent studies also relate social networking applications such as YouTube, Twitter, or Facebook to SP (Karimov, Brengman, & Van Hove, 2011).

In summary, mainly two perspectives of SP can be identified. On the one hand, the emotional understanding refers to human warmth and closeness of an interaction. Here, Short et al. (1976) use a measurement including pairs of e.g. cold/warm, impersonal/personal or insensitive/sensitive. This measurement scale was developed further by Gefen & Straub (1997) in order to measure the degree of SP of a website. On the other hand, the evaluative understanding refers to rational evaluation and monitoring of actions. Here, the focus lies on performance influence through SP (social facilitation). Thus, while performance is measured in e.g. task completion time or correctness, SP is often only used as a manipulation check (e.g. if a person realizes that he/she is monitored) (Feinberg & Aiello, 2006; Zanbaka et al., 2004).

2.2 Dimensions of Social Presence Design

Design dimensions are aspects that can be manipulated in experiment studies in order to influence the dependent variable, in our case SP (e.g. Cyr et al. 2009; Hess et al. 2009). The basic model of communication consisting of sender, channel and receiver and can be refined by adding environmental aspects (Casstevens, 1979). We develop our framework along these dimensions with *Media Characteristics* (analogous to the channel by which a message is transmitted), *Communicational Characteristics* (corresponding to sender and receiver) and *Contextual Factors* (similar to environment aspects in the refined communication model). The perspective of SP is generally seen from the sender perceiving a receiver. However, it can also be conceptualized as the ability to project a sense of self through the limitations of a medium (Savicki & Kelley, 2000). Although we acknowledge

both perspectives, this paper focuses on the perception of SP by the sender in order to account for non-human SP artifacts such as recommendation agents.

We develop the framework based on SP studies from the Human-Computer Interaction (HCI) and applied psychology literature. The literature in these fields provides deep theoretical insight on different dimensions of the (social) presence concept, and, thus, can be considered well suited for the purpose of our study.

2.2.1 Media Characteristics

The first group of design dimensions is related to the communication medium itself. As such the following design dimensions have a technical nature and can be manipulated by hardware and software configurations.

The first design dimension concerns the richness of the interaction medium, i.e. how many channels of social information it conveys, the number and types of social context cues transmitted, or the mode(s) of communication (e.g., text, auditory, visual) (Swinth & Blascovich, 2002). This description is similar to the media richness concept, defined as "the ability of information to change understanding within a time interval" (Daft & Lengel, 1986, p. 560). In the light of current developments, richness is not only the difference between a distinct text, audio or video condition but also the number of (social) cues that are conveyed in mediated collaborative work environments or virtual worlds by embodied avatars and virtual agents (Biocca, Harms, & Burgoon, 2003).

The second design dimension, synchronicity, refers to the co-temporality of a medium. For instance, the receiver in a synchronous communication receives the message roughly at the same time it is sent (Clark & Brennan, 1993), whereas in an asynchronous communication situation there is a clearly perceived time delay between sending and receiving. In general, synchronicity is rather a continuum than a dichotomic construct because a face-to-face talk is very synchronous, a text-chat may be considered as something in between and an email as rather asynchronous. However, this distinction as a property of a communication medium does not hold true for any situation. For instance, assuming the same level of availability of communication partners, an e-mail communication is very similar to a text chat, when email messages are kept as short as text chat messages used to be. Similarly, literature has identified simultaneity as important for social presence (Clark & Brennan, 1993). In a simultaneous interaction, communication partners can send and receive messages at same time. We see this distinction as a sub-dimension of synchronicity as it is dependent on a synchronous communication situation.

Perceived realism is the third design dimension of media characteristics. According to Lombard & Ditton (1997) perceptual realism is "the degree to which a medium can produce seemingly accurate representations of objects, events, and people – representations that look, sound, and/or feel like the "real" thing". The authors define social realism as "the extent to which a media portrayal is plausible or "true to life" in that it reflects events that do or could occur in the non-mediated world". For static visual elements such as pictures the design dimension becomes vivid when comparing cartoon images that represent people with high resolution pictures from a single lens reflex (SLR) camera. This distinction in different degrees of perceived realism is especially true for avatars and recommendation agents where not only visual and audio elements but also behavior and interaction are evaluated in terms of realism (Swinth & Blascovich, 2002). In this case behavioral realism refers to the extent to which avatars and other objects in a virtual environment behave like their counterparts in the physical world (Bailenson, Yee, Merget, & Schroeder, 2006).

The last design dimension for characteristics of the medium is the degree of communication interactivity in terms of visibility and audibility (Clark & Brennan, 1993). In terms of visibility, situations are considered in which only one person is able to see the other person (e.g. only one webcam is used) versus a situation where both communication partners can see each other. Again, this design dimension can be considered as a continuum when thinking about situations where one person

fully and the other person just partly sees each another (e.g. one high resolution webcam versus a blurred or low resolution webcam). The analogous situation is true for audibility e.g. in terms of microphone usage.

2.2.2 Communicational Characteristics

Communicational characteristics are aspects that describe the sender of the SP impulse. These aspects relate to humans and artificial agents in the same way, i.e. also recommendation agents can be designed with different personalities (Hess et al., 2009).

The first communicational characteristic is group size. We deliberately name this category group size and not team size as a team implies a shared task goal which is conceptualized as a distinct dimension. In this context, groups of different sizes may be compared against each other in terms of creating social presence (Roberts, Lowry, & Sweeney, 2006). For instance, a study by Lowry et al. (2006) studied the impact of group size and SP on group communication. Group sizes may vary from single, dyads, virtual teams up to virtual communities (Kumar & Benbasat, 2002).

Secondly, design may be iterated along the dimension of personal dispositions also referred to as intrapersonal factors (Swinth & Blascovich, 2002). This dimension contains both behavioral engagement such as eye contract, non-verbal mirroring, turn taking behavior in dialogues (e.g. frequency of interruptions) or vocal cues (e.g. tone of voice) (Biocca, Burgoon, Harms, & Stoner, 2001; IJsselsteijn et al., 2003). In addition, other factors regarding affective (e.g., mood), dispositional (e.g., personality, temperament, intelligence) or demographic characteristics are subsumed within this dimension (Swinth & Blascovich, 2002). For the former group, Riva suggests that the highest level of SP occurs when the environment is able to support the full intentional chain of behavioral actions of the other (Riva, 2008).

Finally, the interpersonal relationship is considered as a design dimension of SP (Swinth & Blascovich, 2002). Aspects in this dimension relate to the relative status to one another; their interaction history; their attitudes, beliefs, and expectations about one another; and the extent to which they perceive each other to be attentive, involved, and responsive within the interaction (Swinth & Blascovich, 2002). Furthermore, when talking about SP as social facilitation the power distance (e.g. hierarchical level in an organization) may influence SP effects (Bond & Titus, 1983).

2.2.3 Contextual Characteristics

Contextual Characteristics are neither part of the medium itself nor of the interacting entities. They can be seen as environmental factors that are part of the present situation in which the SP related scenario takes place.

The first task related design dimension relates to the task type. Examples for different task types are activities such as problem solving, decision making, exchanging opinions and generating ideas (Biocca, Burgoon, et al., 2001). In this context, Straus & McGrath (1994) identified differences between computer-mediated and face-to-face groups in the quality of the work completed across three different tasks, namely an idea-generation task, an intellective task, and a judgment task.

Second, as can be seen from the above mentioned task type examples, task goals can vary. On the one hand, there are tasks where the task goal is independent (e.g. doing shopping on a website with socially rich elements (Hassanein & Head, 2007). On the other hand, there are collaborative tasks such as decision problems in virtual teams (Yoo & Alavi, 2001).

As a final context factor there may be a varying level of distraction across real life situations and laboratory experiment designs. Research in this area has described the concept of presence as immersions as the degree to which a virtual environment submerges the perceptual system of the user (Biocca & Delaney, 1995; Lombard & Ditton, 1997). For instance, Lobard & Ditton (1997) describe

examples such as head-mounted display in order to cover the eyes and make the real world invisible or the use of headphone to muffle ambient sound. As noise and other environmental distractions are reduced, individual's attention and perception of SP is higher (Swinth & Blascovich, 2002). The complete framework with all different SP dimensions is depicted in Figure 1.

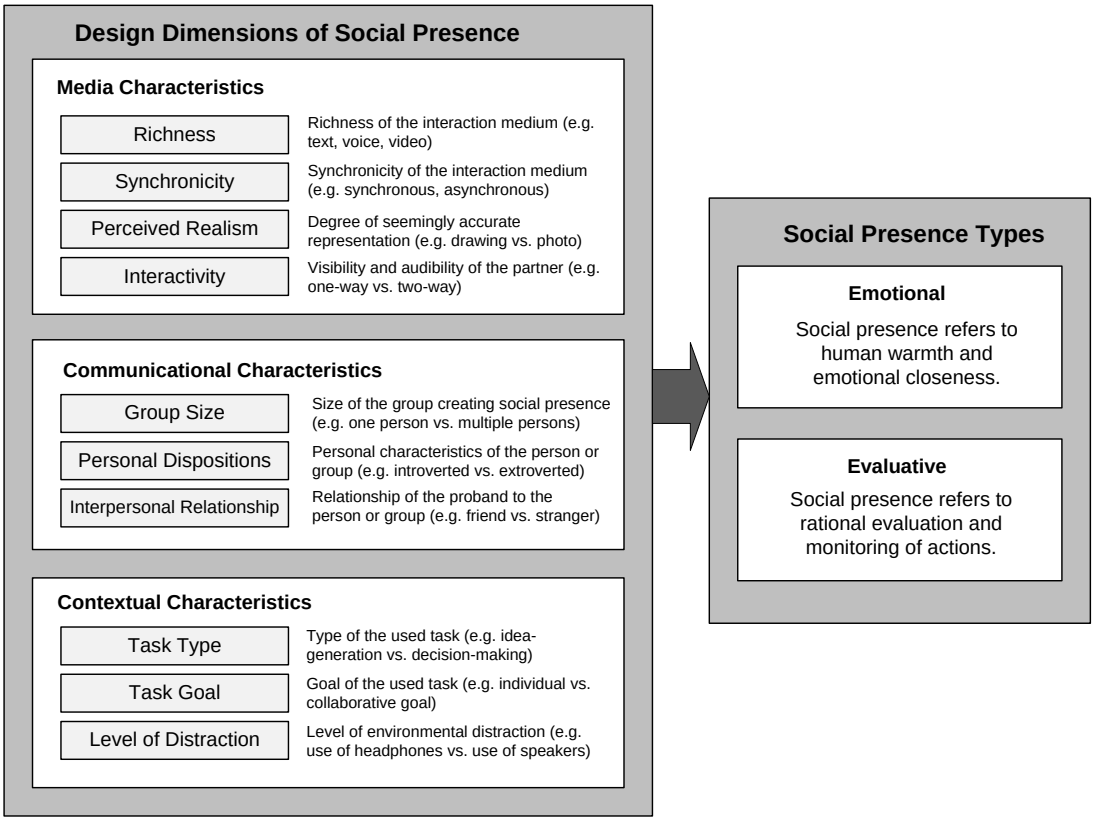

Figure 1. Framework of Social Presence Design Dimensions in Information Systems

3 Method

In order to address our research objectives, we conducted a structured review of IS literature (Webster & Watson, 2002). For this matter, we employed a two-step search process including a database search (ISI web of science) followed by a forward and backward search starting with the previously identified articles. For the former, our search terms included e.g. "social presence", "copresence", "social facilitation" and "social inhibition". We used these terms to search in both abstract and keywords. We included all AIS top-basket journals, i.e. European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, and MIS Quarterly as well as all IS journals that received a ranking point average below 20 in the AIS journal ranking meta review (including e.g. Communications of the ACM, Information & Management, and Artificial Intelligence). From the search process, we identified a total of 58 candidate papers which were then analyzed by the three researchers.

The analysis was conducted in two consecutive steps. 1) Screening. The three researchers independently screened the papers for relevance with respect to the research questions. We only considered papers that a) were published in the above mentioned journals and b) included SP as a key construct in their research model. Then, the outputs of this individual screening were discussed and consolidated in a group effort to come up with a list of relevant papers for the main analysis. 2)

Detailed analysis. In a next step, the selected papers were analyzed along the developed framework dimensions. In this stage, we only considered studies were SP was manipulated. This analysis was again first performed individually by the researchers and then consolidated in a workshop setting to eliminate misunderstandings with respect to the SP (design) dimensions. Within this group workshop, each study was mapped to both the SP design choice and the type of measurement as developed in the framework.

4 Results

4.1 Media Characteristics

There are many studies that iterate the classical richness level in terms of text, audio or video conditions (Al-Natour, Benbasat, & Cenfetelli, 2011; Aljukhadar, Senecal, & Ouellette, 2010; Hess et al., 2009; Qiu & Benbasat, 2009; Yoo & Alavi, 2001; Zhu et al., 2010). For example, a privacy disclosure statement is presented in all three different conditions (Aljukhadar et al., 2010); a recommendation agent either communicates by text or by text-to-speech (Hess et al., 2009); a text vs. voice chat is used as communication support (Zhu et al., 2010). A second set of studies simply embeds human pictures (Cyr et al., 2009), or pictures and socially rich text (Hassanein & Head, 2005) in websites. Similarly, other research has compared traditional email to email with an additional customizable picture of the user (Lee, Kozar, & Larsen, 2009) investigated into the SP effects of enriching an online auction with pictures of the users (Rafaeli & Noy, 2002). A third set of studies shows the difference between face-to-face settings and computer mediated settings (Burke & Chidambaram, 1999; Lowry, Zhang, Zhou, & Fu, 2010; Sia, Tan, & Wei, 2002; Zhang, Lowry, Zhou, & Fu, 2007). For example Franceschi, Lee, Zanakis, & Hinds (2009) study differences between a traditional classroom setting, a text-based and a 3D-virtual virtual learning environment.

Besides the aforementioned face-to-face vs. computer-mediated conditions, there is only one study that manipulates the level of synchronicity. While in this study synchronous groups met at the same time, members of asynchronous groups were not permitted to sign on simultaneously (Burke & Chidambaram, 1999). Regarding simultaneity, no study with multiple design choices could be identified.

Two studies could be identified that manipulate the perceived level of realism. First, human image facial characteristics are manipulated (in one case no facial characteristics were shown compared to a situation with facial characteristics) (Cyr et al., 2009). Second, a recommendation agent used either text-to-speech versus human voice (Qiu & Benbasat, 2009).

In terms of communication interactivity, two studies presented different design choices. In the study of Lowry, Romano, Jenkins, & Guthrie (2009) students had to answer questions either using a handheld response pad (anonymous) or by openly raising their leading to an open verbal discussion among the participants. A second study manipulated interactivity by using either separate or shared (i.e. synchronous view of webpages) navigation on webpages (Zhu et al., 2010).

4.2 Communicational Characteristics

For group size no study could be identified that deliberately changes the size of the participating groups in order to show effects on SP.

In human-human interaction situation personal dispositions could be manipulated if a group of senders is instructed to behave in a different way than other groups. However, in our sample only studies with recommendation agents are identified. First, there is a controlled behavior manipulation of an online shopping assistant by either making use of a normative-based vs. a heuristic-based decision strategy (Al-Natour et al., 2011). Second and third, there are studies that either manipulate dominant vs.

submissive (Al-Natour et al., 2011) or extra- vs. introverted personality and behavior (Hess et al., 2009). In addition, there are three studies that manipulate the ethnicity of the sender (Cyr et al., 2009; Lowry et al., 2010; Zhang et al., 2007). However, these three studies do not test the influence on SP.

	Media Characteristics				Communicational Characteristics			Contextual Characteristics			Social Presence		
Author (Year)	Richness	Synchronicity	Perceived Realism	Comm. interactivity	Group size	Personal disposition	Relationship to receiver	Task type	Task goal	Level of distraction	Emotional	Evaluative	Not measured
Aljukhadar et al. (2010)	X										X		
Choi et al. (2011)							X				X		
Al-Natour et al. (2011)	X					X					X		
Burke & Chidambaram (1999)	X	X									X		
Ma & Agarwal (2007)							X						X
Cyr et al. (2009)	X		X								X		
Hassanein & Head (2005)	X												X
Franceschi et al. (2009)	X										X		
Hess et al. (2009)	X					X					X		
Kumar & Benbasat (2006)							X				X		
Lowry et al. (2009)				X								X	
Lowry et al. (2010)	X												X
Pavlou et al. (2007)								X			X		
Qiu & Benbasat (2009)	X		X								X		
Saunders (2011)								X			X		
Sia et al. (2002)	X												X
Yoo & Alavi (2001)	X						X				X		
Zhang et al. (2007)	X												X
Zhu et al. (2010)	X			X							X		
Lee et al. (2009)	X										X		
Rafaeli & Noy (2002)	X											X	
Sum	15	1	2	2	0	2	4	2	0	0	14	2	5

Table 1. Mapping of empirical social presence literature to design dimensions

In terms of the receiver's interpersonal relationship with the sender, studies test the impact of recommendations from public users versus recommendation from friends (Choi, Lee, & Kim, 2011), communities of common interests (Ma & Agarwal, 2007) or online shop providers (Kumar & Benbasat, 2006). Other research distinguishes between newly formed and established groups (Yoo & Alavi, 2001). In addition, Lee et al. (2009) iterate the hierarchical level between sender and receiver but do not explicitly test for effects on social presence.

4.3 Contextual Characteristics

Regarding the task type, only few IS papers iterate their research design along this dimension. For instance, Pavlou et al. (2007) measure the perceived SP of shopping for a book versus shopping for

prescriptive drugs. Furthermore, Saunders et al. (2011) study the design of virtual worlds for different tasks, namely brainstorming, idea organizing or voting, and measures SP subsequently. In addition, one study could be identified that manipulates a task in terms of its equivocality (Lee et al., 2009). However, the authors did not explicitly test the impact of this manipulation on SP. For different task goals and levels of distraction none of the identified IS studies compared different design choices.

4.4 Social Presence Types

On the one hand, fourteen of the twenty-one studies use an emotional understanding of the perceived SP. Thereby the authors generally refer to items based on Short et al. from 1976 which measures SP in the sense of human warmth, personalness, sensibility and sociability. On the other hand, only two studies refer to evaluative SP measurements. For example, participants stated that they felt inhibited from participating in the interaction because of the behavior of other group members (Lowry et al., 2009). The remaining five studies did not explicitly measure the degree of perceived SP. Instead, in these studies comparing a face-to-face to a computer-mediated condition, it is taken for granted that SP in the former condition is higher than in the latter (e.g. Zhang et al., 2007).

5 Discussion and Conclusion

The results of our analysis have several implications for future theory building efforts. With respect to the design dimensions, current IS literature mainly focuses on iterating media richness. The analyzed papers mainly differentiate between text, audio and video conditions. Only few studies could be identified that focus on testing different synchronicity, realism or interactivity settings. Thus, (design) theory building in the context of SP currently mainly relies on insights regarding differences between interaction media. However, in order to design systems that evoke SP, the choice of media may not be the only important factor. Here, IS research needs broaden its scope to include testing the impact of other dimensions as well.

Furthermore, regarding communicational characteristics, it is interesting to see that in terms of the interaction partners' behavior and personal disposition, only manipulations for recommendation agents exist. This might relate to difficulties of experimental research to control for a desired behavior with humans, e.g. an experiment supervisor is not capable of acting invariantly in a desired way across interactions with multiple participants. However, for personal dispositions, this problem could be overcome by a polarized sample e.g. inviting only very old and very young participants.

With regards to contextual factors, our results imply that the application of SP across various task scenarios is still under-researched. Especially for practical applications, task characteristics play a central role. For instance, there may be contexts (e.g. shopping) where the inclusion of recommender agents will have more positive effects on SP than in other settings. Furthermore, additional research across task types is necessary because simply more SP may not always be desirable. Thus, besides understanding how SP is created and how more SP can be perceived, the question of the adequate SP level for certain tasks and communication partners with specific preferences needs to be considered in future theory building and evaluation.

In addition, the SP construct is mainly understood in terms of human warmth and closeness, i.e. most studies focused on emotional aspects. Most studies used very similar measurement items. The evaluative, performance-inducing understanding of the construct, as developed e.g. by social facilitation theory (Aiello & Kolb, 1995; Zajonc, 1965) is not yet pursued in IS research. This has also been found by Schultze stating that "one question prior research on presence fails to answer pertains to the value of presence with respect to certain outcomes like task performance and learning" (p. 446) (Schultze, 2010). It currently remains unclear in how far particular design decisions may contribute to fostering performance by means of raising the SP level. While research on (virtual) social facilitation provided evidence on the potential positive effect of SP on task performance (Aiello & Kolb, 1995;

Davidson & Henderson, 2000; Kolb & Aiello, 1997), IS research has not yet taken this perspective and elaborated on the possible impact of different technological design decisions in this context. For instance, the framework dimension communication interactivity could play a central role due to its comprising elements visibility and audibility. These two aspects may play a key role in determining to which degree a person can be monitored and evaluated and, thus, could be considered a valid starting point for research in this context. Additionally, interpersonal relationships may also play an important role when different levels of power distance between the communication partners are considered (e.g. people from different hierarchy levels).

Overall, our study may assist in future theory building efforts by pointing out shortcomings of current IS research and possible areas for future investigation. In addition, it provides a well-structured overview on the design decisions of related IS studies in the context of SP and, thus, can be considered valuable for researchers in this area. The framework dimensions may be used as input when deciding upon which aspects to consider in a study on potential factors influencing SP. Furthermore, the underlying idea of the framework, i.e. the analysis of design dimensions, may be used to guide future literature reviews in IS. However, our study has certain limitations. On the one hand, we only included journal papers in our review and did not focus on conference proceedings. While we believe that results would have been similar including conference papers, extending the review in this direction may be considered a task for future research. Another limitation concerns the framework dimensions. On the one hand, while the design dimensions were derived using established (e.g. psychology) literature in the area of SP, we do not claim comprehensibility of our framework. For instance, there may be upcoming technical revolutions that lead to new design dimensions or emphasize existing design dimensions in a way that they need to be split up. However, we believe that we identified the major design dimensions relevant for IS research as all of the identified studies could be mapped using the framework. On the other hand, we did not include the analysis of possible dependent variables in the context of SP. In this context, future research could focus on developing a comprehensive review on the effects of SP when created using digital interaction media.

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